Statement of
Margo Thorning, Senior Vice President and Chief Economist
American Council for Capital Formation
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INTRODUCTION

My name is Margo Thorning. 1 am Senior Vice President and Chief Economist of the American Council for Capital Formation (ACCF).

The ACCF represents a broad cross-section of the American business community, including the manufacturing and financial sectors, Fortune 500 companies and smaller firms, investors, and associations from all sectors of the economy. Our distinguished board of directors includes cabinet members of prior Republican and Democratic administrations, former members of Congress, prominent business leaders, and public finance and environmental policy experts.

The ACCF is now celebrating its twenty-fifth year of leadership in advocating tax, regulatory, and environmental policies to increase U.S. economic growth and environmental quality.

We commend Chairman McIntosh and the Subcommittee on National Economic Growth, Natural Resources, and Regulatory Affairs for their focus on the critical issue of the effect of climate change policy on U.S. economic growth.

My testimony begins first with a review of several analyses sponsored by the ACCF Center for Policy Research, the public policy research affiliate of the American Council for Capital Formation. These analyses illustrate the economic and environmental impact of near-term limitations on the growth in U.S. carbon emissions. Next, the testimony will describe the likely parallel between the energy shocks of the 1970s and 1980s with the energy cutbacks required of the United States by the Kyoto agreement. Third, I discuss the environmental impact of carbon dioxide (CO,) stabilization by developed countries alone. Finally, strategies for a cost-effective, long-term approach to stabilization of CO, concentrations are presented.

MACROECONOMIC EFFECTS OF CO, EMISSION LIMITS

The Kyoto Protocol to the United Nations Framework Convention on Climate Change, which the United States negotiated in December, 1997, calls for industrial economies such as the United States, Canada, Europe, and Japan to reduce their collective emissions of six greenhouse gases by an average of 5.2 percent from 1990 levels by

2008-2012. The U.S. target is a 7 percent reduction from 1990 levels. Many experts believe that the Kyoto agreement has potentially serious consequences for all Americans. and that these consequences have not been fully analyzed and understood.

Research conducted over the past decade for the ACCF Center for Policy Research by top climate change scholars such as Professor Gary W. Yohe of Wesleyan University, Dr. Lawrence M. Horwitz of Primark Decision Economics, WEFA, Inc. Senior Vice President Mary H. Novak, Professor Richard Schmalensee of the Massachusetts Institute of Technology, Professor Alan S. Manne of Stanford University, Dr. Richard Richels of the Electric Powet Research Institute, and Dr. W. David Montgomery of Charles River Associates concludes that the cost of stabilizing CO, emissions in the near term would impose a heavy burden on U.S. households and industry.

■ Impact on Economic Growth

These macroeconomic studies estimate the economic impact of stabilizing CO, emissions at 1990 levels (this was the Administration's original, pre-Kyoto, emission reduction target). Thus, the results shown below are lower-bound, conservative estimates of the Kyoto agreement's impact since, as mentioned above, the agreement calls for the United States to reduce its emissions 7 percent below 1990 levels (or about 30 percent more than was modeled in studies sponsored by the ACCF Center for Policy Research).

For example, Dr. Horwitz's study shows that reducing emissions to 1990 levels by 2010 or 2015 would require a carbon tax in the range of $200 or more per tonne of carbon emitted. Dr. Horwitz argues that this tax would reduce U.S. GDP growth by more than 4.0 percent annually or over $350 billion per year. As emissions were reduced, economic growth would slow due to lost output as prices rise for cat-bon-using goods-goods that must be produced using less carbon and/or more expensive processes. Output would also fall because of slower net capital accumulation, reflecting the premature obsolescence of capital equipment due to sharp energy price increases. A study presented last year by WEFA's Ms. Novak concludes that stabilization would require a carbon tax of $200 per ton and would send a prolonged series of shocks through the economy, causing major changes in production patterns and resulting in significant economic losses. For example, GDP would fall by 2.4 percent by 2010. Professor Yohe concludes that emission stabilization would require a tax of as much as $260 per ton and that U.S. GDP growth would slow by 1 percent annually.

■ Impact **on Income, Wages and Employment**

The analyses by Dr. Horwitz, Professor Yohe, and Ms. Novak conclude that stabilization of CO, emissions at 1990 levels would reduce real wage growth and raise unemployment. Dr. Horwitz predicts that household disposable income would fall by 1.2 percent, and wages would also drop. Ms. Novak concludes that the average U.S. household would have $2,061 (in 1996 dollars) less income by 2010. Professor Yohe's analysis shows that stabilization would cause real wages would fall by 5 to 10 percent per year.

■ Impact on Household Consumption and Lifestyles

Stabilizing emissions at 1990 levels requires raising energy prices sharply in order to reduce demand. Energy price increases result in higher prices for the goods and services purchased by consumers (see Figure 1). Ms. Novak's "stabilization" analysis shows that by 2010, food and medicine would be 8 to 10 percent more expensive, gasoline would be about 35 percent more costly, and consumers would pay about 50 percent more for electricity. In response to sharply higher energy prices, U.S. consumers would be forced to make major changes in their lifestyles, including lowering their thermostats in winter, driving less, and reducing their use of air conditioning in summer. Studies by Drs. Yohe and Horwitz show that as a result of higher prices and lower income, household consumption of goods and services such as electricity, gasoline, natural gas, autos, and housing are curtailed. For example, electricity use drops by an average of 30 percent, natural gas by 17 percent, and auto purchases by 8 percent (see Figure 2).

■ Impact on Income Distribution

Policies to curb emissions not only reduce employment and income growth and curtail household consumption, they also worsen the distribution of income in the United States, according to the analyses of both Professor Yohe and Ms. Novak. For example, based on a standard measure of the degree of income inequality among a country's population called the GINI coefficient, Professor Yohe's analysis shows that carbon taxes, even when recycled through personal income tax reductions, cause relatively large losses in the poorest quintile (lowest one-fifth of the population). These losses, added to modest losses in the middle quintiles, underwrite gains for the richest fifth of the population (see Figure 3).

THE ENERGY CRISIS OF THE 1970s AND THE IMPACT OF THE KYOTO AGREEMENT

Policies designed to stabilize CO, emissions at 1990 levels by 2010 are likely to cause consumers to feel as though they are living through the oil price shocks of the early 1970s and 1980s all over again. Professor Yohe compares the impact of CO, stabilization at 1990 levels on income inequality with actual experience during those time periods. Figure 4 compares changes in income inequality in the recent past, as measured by the GINI coefficients, with those predicted if the United States imposes carbon taxes to stabilize emissions. The black bars in Figure 4 represent: (1) 1968-73, the period prior to the oil shocks of the 1970s; (2) 1973-78, the period of the most dramatic increase in oil prices; and (3) 1978-83, the subsequent period of sharply rising oil prices and dramatic recession.

The tallest black bar, showing the GINI coefficient increasing by 3.5 percent, reflects the growth of income inequality in the United States from 1978 through 1983. The distributional effects of the 1980s recession were noticed by nearly everyone and documented in the professional and popular press. Poverty rates climbed. Unemployment hit highs that had not been seen since the Great Depression. For example, in 1983 the unemployment rate reached 9.6 percent. Plants and factories closed and people moved in search of jobs and/or improved public assistance.

It is equally significant that the second largest distributional effect depicted in Figure 4 (an increase in the GINI coefficient of 2.5 percent) reflects the cost of a carbon tax designed to achieve stabilization in emissions—an income tax recycling scheme that could have a distributional effect about 70 percent as large as the effect of the 1980s recession. Put another way, contrasting the more "normal experience" of 1968 through 1978 with the effects of a carbon tax, it is easy to see that other policies designed to stem even the long-term trend toward less equitable distributions of income might have to work more than twice as hard just to hold the line if they were forced to work in a overall policy environment that included either substantial taxes or required the use of tradable permits to stabilize carbon emissions.

Level of Effort Required to Meet the Kyoto Targets

Another way of measuring the effort or sacrifice required to meet the Kyoto emission targets is presented in a new study by Ms. Rayola Dougher and Dr. Russell Jones of the American Petroleum Institute. The Dougher and Jones study takes neither the traditional macroeconomic, general equilibrium modeling approach nor the engineering technology approach. Instead, it takes a simpler but more intuitive approach using the Kaya Identity, which is described below. This approach, using 35 years of history plus government projections of growth in GDP and energy use through 2010, provides a yardstick to evaluate how much behavior must be altered from current and expected patterns in order to meet the Kyoto targets and how this altered behavior compares to past experience, especially the effort to limit energy during the energy crisis years of 1974-1986.

As Dougher and Jones note, the Kaya Identity analysis provides a useful tool for characterizing past changes in key factors impacting carbon emissions. It also allows a comparison with the types of changes required to meet future emission targets. Under the Kaya Identity formulation, carbon emissions depend upon the carbon content of energy used in the economy, the energy intensity of economic activity, per capita GDP, and population. In equation form the Kaya Identity is:

$$C = C/E * E/GDP * GDP/Population * Population$$

where C equals carbon emissions and E equals energy use. For small to moderate changes in the Kaya Identity components between any two given years, the sum of the percent changes in each of the components closely approximates the change in carbon emissions between those two years.

It should be noted that the Kaya Identity, by itself, says little about the nature of policies that would be required to reach the Kyoto targets. The Kaya Identity also does not evaluate the cost to the economy of changes in what and how products are made and consumed. Instead, it illustrates the trade-offs between the key factors affecting carbon emissions. Comparing past and forecast changes in these key factors provides a framework for measuring the level of effort that would be required to achieve the carbon emission reduction targets set in Kyoto.

Table 1 shows the average annual percentage changes in carbon emissions and the key factors affecting these emissions in the United States, Japan, and the European Union over different time periods. Reading from left to right, the percentage changes in carbon

Table 1 Key Factors Affecting Carbon Emissions
Average annual percentage changes

Country/Region	1 Carbon Emissions	2 Carbon/ Energy	3 Energy/ GDP	4 GDP/ Population	5 Population
THE EARLY YEARS, 1961-1973					
United States	4.0	-0.2	0.3	2.7	1.2
European Union	5.0	-0.9	1.1	4.0	0.7
Japan	10.4	-0.6	1.3	8.4	1.2
THE ENERGY CRISIS YEARS, 1974-1986					
United States	0.0	-0.2	-2.1	1.3	1.0
European Union	-0.4	-1.1	-1.4	1.8	0.3
Japan	-0.1	-1.1	-2.3	2.5	0.9
RECENT HISTORY, 1987-1995					
United States	1.4	-0.4	-0.4	1.3	1.0
European Union	0.2	-0.8	-1.1	1.8	0.4
Japan	3.0	-0.6	0.6	2.6	0.4
BUSINESS-AS-USUAL FORECASTS, 2001-2010					
United States	1.3	0.1	-0.9	1.3	0.8
European Union	0.5	-0.2	-1.5	2.1	0.1
Japan	0.2	-1.1	-1.3	2.4	0.2

Source: Rayola Dougher and Russell Jones, "OECD Country Carbon Emissions: A Kaya Identity Perspective on Historic Emissions and Proposed Emission Reduction Targets and Timetables," *Proceedings of the 21st IAEE Annual International Conference*, forthcoming.

emissions shown in the first column very closely approximate the sum of the percentage changes in each of the key factors shown in the remaining columns.

As Table 1 shows, the only time industrialized countries experienced stable or declining carbon emissions was during the energy crisis years of 1974-1986. Comparing the oil crisis years with the earlier years shows reductions in the per capita GDP (Table 1, Column 4) to be the single most important factor contributing to the decline in carbon emissions between the two periods. In the United States and Europe, growth in the GDP per capita was cut in half, and in Japan it was two-thirds less than it had been.

The second most important contributing factor to the declines in carbon emissions during the oil crisis years, as Dougher and Jones note, was the change in the amount of energy used per dollar of GDP (Table 1, Column 3). In Japan, the Energy/GDP ratio changed from a 1.3 percent per year average increase during the early years of 1960-1973 to a 2.3 percent per year decline during 1974-1986. Similarly, in Europe the ratio changed from a 1.1 percent per year increase to a 1.4 percent per year decline. For the United States, the ratio changed from a 0.3 percent per year increase to a 2.1 percent per year decline.

■ Kyoto Target: Maximum Historic Effort Case

As Dougher and Jones observe, one of the difficulties in evaluating public policy is reflected in the dictum: you never do only one thing. A strength of the Kaya Identity approach is that it can be used to evaluate what emissions would be under specific assumptions about the various Kaya Identity components. In Table 2 the Kaya Identity is used to answer the question of what emissions would be in 2010 if the maximum past efforts at limiting carbon emissions in each Kaya Identity component were somehow to reoccur simultaneously for the next decade.

The authors conclude that the United States falls far short of the Kyoto target even under the maximum historic effort scenario, which yields an emissions reduction of 1.1 percent per year compared to a 2.3 percent per year reduction required to reach the Kyoto target (see Table 2). The EU just meets the Kyoto target under this scenario, although cutting the growth in GDP per capita in half, as in the United States, was a requirement for this achievement. Japan's emissions fall more rapidly than required to meet the Kyoto target under the maximum historic scenario. However, as with the EU, without a 50 percent reduction in the rate of growth in per capita GDP, Japan also would miss the Kyoto target.

The Kaya Identity analysis casts serious doubt on the claim that the Kyoto target is realistic. In the past, achieving the assumed maximum historic efforts required rapidly rising energy prices, an expanding nuclear power sector, deregulation of the energy sector, significant advances in technology, and a host of government efficiency programs. Even if the maximum historic effort were repeated, the United States would not achieve the Kyoto target (see Figure 5). And the EU and Japan only achieve the target if the rate of growth in per capita GDP is cut in half. This indicates that the effort required to reach the Kyoto targets would be quite large.

Table 2 Maximum Historic Effort Case for 2001-2010
Average annual percentage changes

UNITED STATES					
Case	1 Carbon Emissions	2 Carbon/ Energy	3 Energy/ GDP	4 GDP/ Population	5 Population
BAU Projection	1.3	0.1	-0.9	1.3	0.8
Max. Effort Case	-1.1	-0.4	-2.1	0.6	0.8
Kyoto Target	-2.3				

EUROPEAN UNION					
Case	Carbon Emissions	Carbon/ Energy	Energy/ GDP	GDP/ Population	Population
BAU Projection	0.5	-0.2	-1.5	2.1	0.1
Max. Effort Case	-1.4	-1.1	-1.4	1.1	0.1
Kyoto Target	-1.3				

JAPAN					
Case	Carbon Emissions	Carbon/ Energy	Energy/ GDP	GDP/ Population	Population
BAU Projection	0.2	-1.1	-1.3	2.4	0.2
Max. Effort Case	-2.0	-1.1	-2.3	1.2	0.2
Kyoto Target	-1.4				

Note: Table 2 summarizes the results of this maximum historic effort what-if scenario. The first line in each section repeats the 'business-as-usual" (BAU) projections while the second line gives the what-if assumptions as well as the resulting annual change in carbon emissions. The short third line gives the annual change in carbon emissions required to reach the Kyoto target.

Source: Rayola Dougher and Russell Jones, "OECD Country Carbon Emissions A Kaya Identity Perspective on Historic Emissions and Proposed Emission Reduction Targets and Timetables," ***Proceedings of the 21st IAEE Annual International*** **Conference, forthcoming.**

ENVIRONMENTAL IMPACT OF EMISSION LIMITS

Economic analysis tells only half the story about policies aimed at reducing near-term U.S. greenhouse gas emissions. Scholars such as Professors Manne and Schmalensee and Dr. Jae Edmonds and his colleagues James Dooley and Marshall Wise of Pacific Northwest National Laboratory (PNNL) [11] warn that there will be almost no environmental benefits if the United States and other industrialized countries were to stabilize CO_2 emissions by 2010 or 2015, because most of the new emissions would come from China, India, the former Soviet Union, Latin America, and other emerging economies. In fact, developing nations, which are not required to cut CO_2 emissions under the Kyoto agreement, already produce about 50 percent of all emissions- a n d by 2050 are expected to produce 75 percent of all greenhouse gases, according to Dr. Montgomery (see Figure 6).

COST-EFFECTIVE CO_2 STABILIZATION POLICIES AND U.S. ECONOMIC GROWTH

A number of economic and environmental analyses provide guidance on how best to balance environmental and economic considerations when formulating climate mitigation policy. Voluntary measures clearly reduce the growth in greenhouse gas emissions, as the U.S. Second National Communication to the Framework Convention on Climate Change noted last year. Moreover, reducing global CO_2 emissions should be a gradual, three-stage process, according to PNNL's Eclmonds, Dooley, and Wise. During the next twenty-five years (Stage I), the United States should commit resources to carbon capture and sequestration as well as the development and spread of new energy technologies such as hydrogen transformation from natural gas, advanced liquefied hydrogen fuel cells, biomass, solar photovoltaic, and nanotechnology (the design and building of structures atom-by-atom). Although such technologies are now in their early stages, their development could revolutionize energy production while sharply reducing the cost of stabilizing atmospheric concentrations of greenhouse gases. Stage II, from 2020-2050, would see the enforcement of an emissions cap; Stage III could see the gradual phaseout of all free-venting of carbon into the atmosphere if the science indicates the need for such a policy.

CONCLUSIONS

The consensus of these noted scholars is clear. Given the need to increase U.S. economic growth to address challenges such as a growing population, the retirement of the baby boom generation, and a persistent trade deficit, policymakers should weigh carefully the likely negative economic impact of precipitous near-term reductions in U.S. CO_2 emissions and energy use. Adopting a thoughtfully timed climate change policy-based on science and improved climate models-would both enhance U.S. and global economic growth and lead to long-term stabilization of carbon concentrations in the atmosphere. ❖

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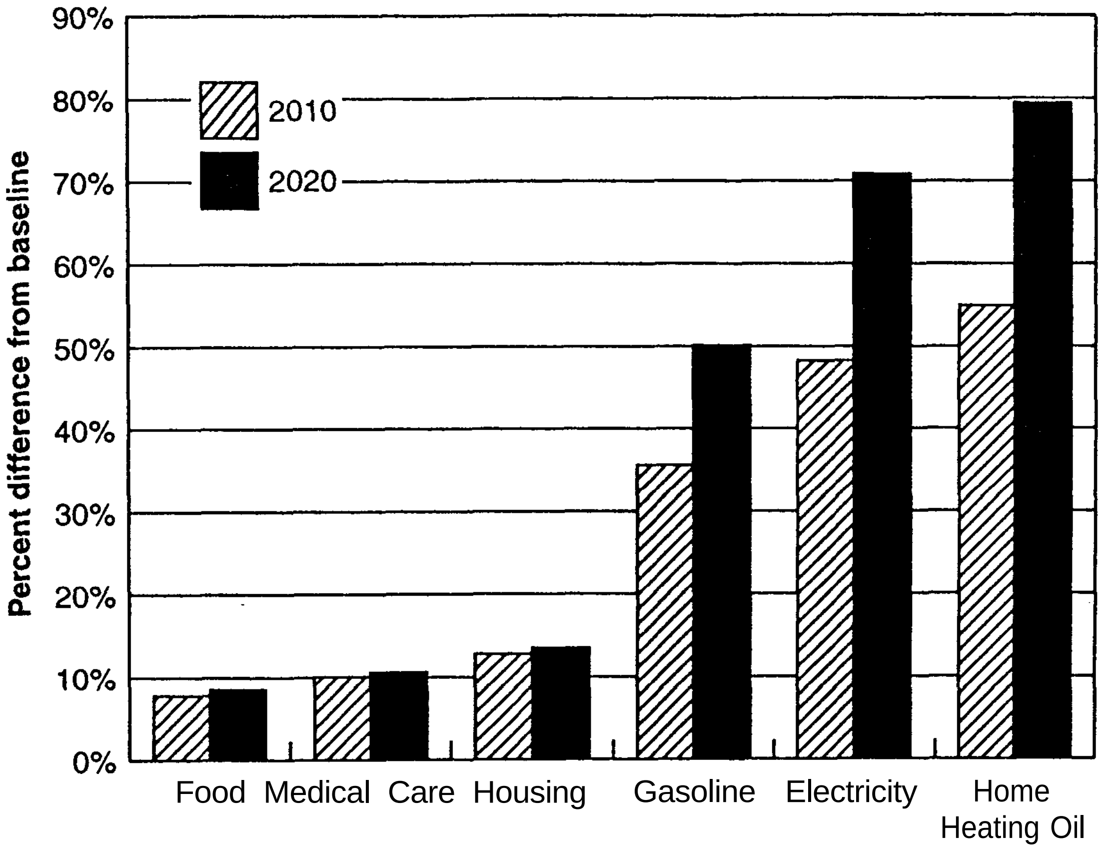
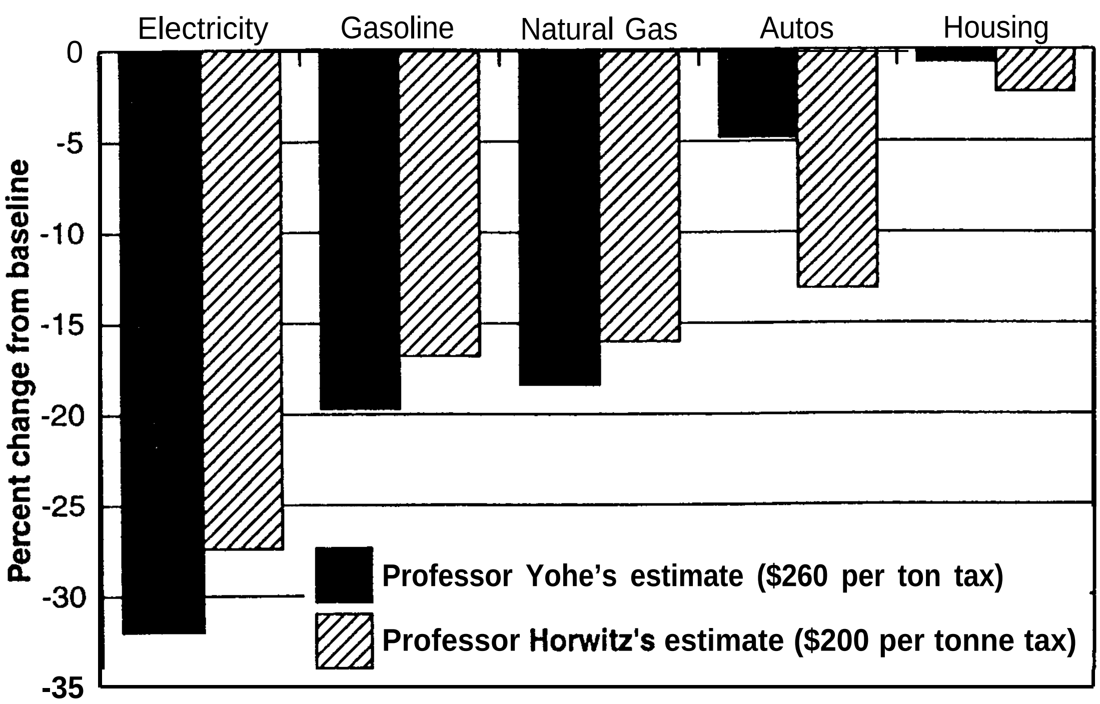
The American Council for Capital Formation and ACCF Center for Policy Research have not received any Federal grants or contracts in fiscal year 1998.

Figure 1 Impact on Prices Paid by Households of Stabilizing Carbon Dioxide Emissions at 1990 Levels
Percent difference from base case



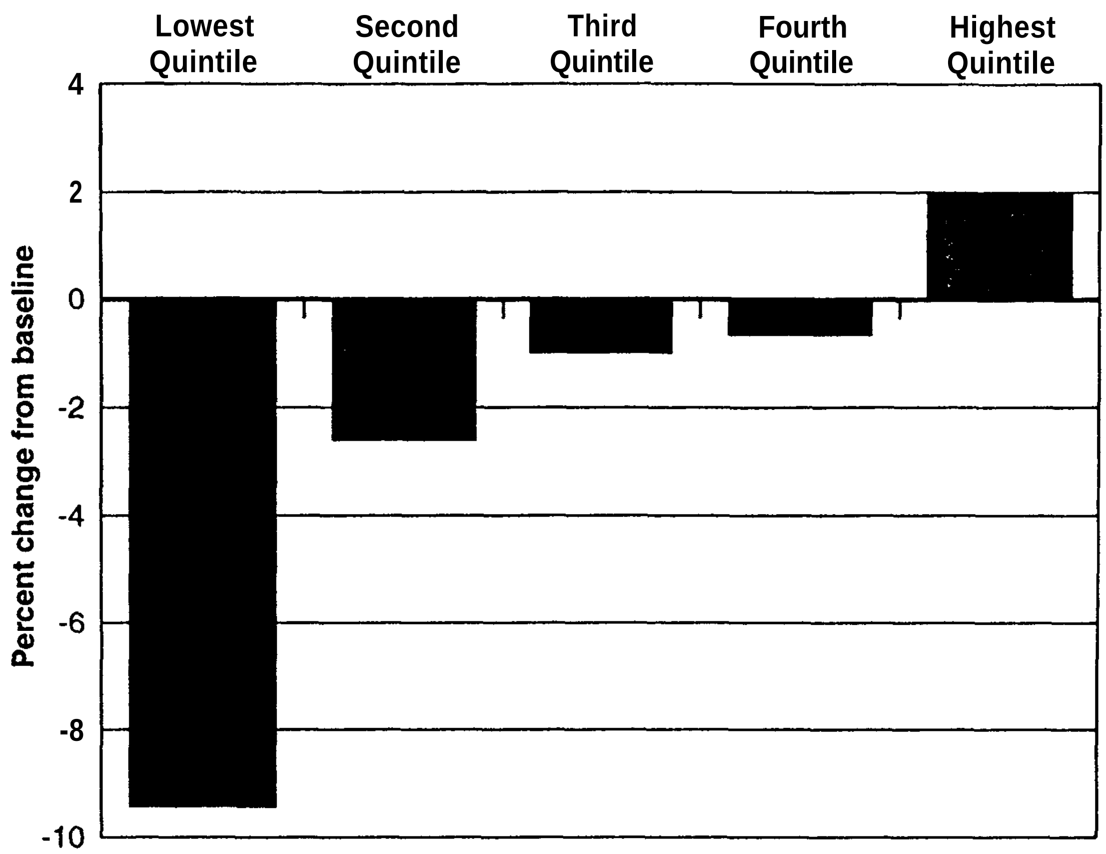
Source: "Global Climate Change, Environmental Quality, and U.S. Living Standards: The Impact on Consumers" by Mary H. Novak, in *The Impact of Climate Change Policy on Consumers: Can Tradable Permits Reduce the Cost?* (Washington, D.C.: American Council for Capital Formation Center for Policy Research, April 1998), pp. 3-18.

Figure 2 Alternative Estimates of the Negative Impacts by 2010 on U.S. Household Consumption Due to Stabilizing Carbon Dioxide Emissions at 1990 Levels



Source: "The Impact of Carbon Taxes on Consumer Living Standards" by Lawrence M. Horwitz, in An Economic Perspective on *Climate Change Policies* (Washington, D.C.: American Council for Capital Formation Center for Policy Research, February 1996), pp. 119-157; and "Climate Change Policies, the Distribution of Income, and U.S. Living Standards" by Gary W. Yohe, in *Climate Change* Policy, Risk *Prioritization, and* U.S. Economic *Growth* (Washington, D.C.: American Council for Capital Formation Center for Policy Research. June 1997), pp. 13-54. Compiled by the American Council for Capital Formation, April 1998.

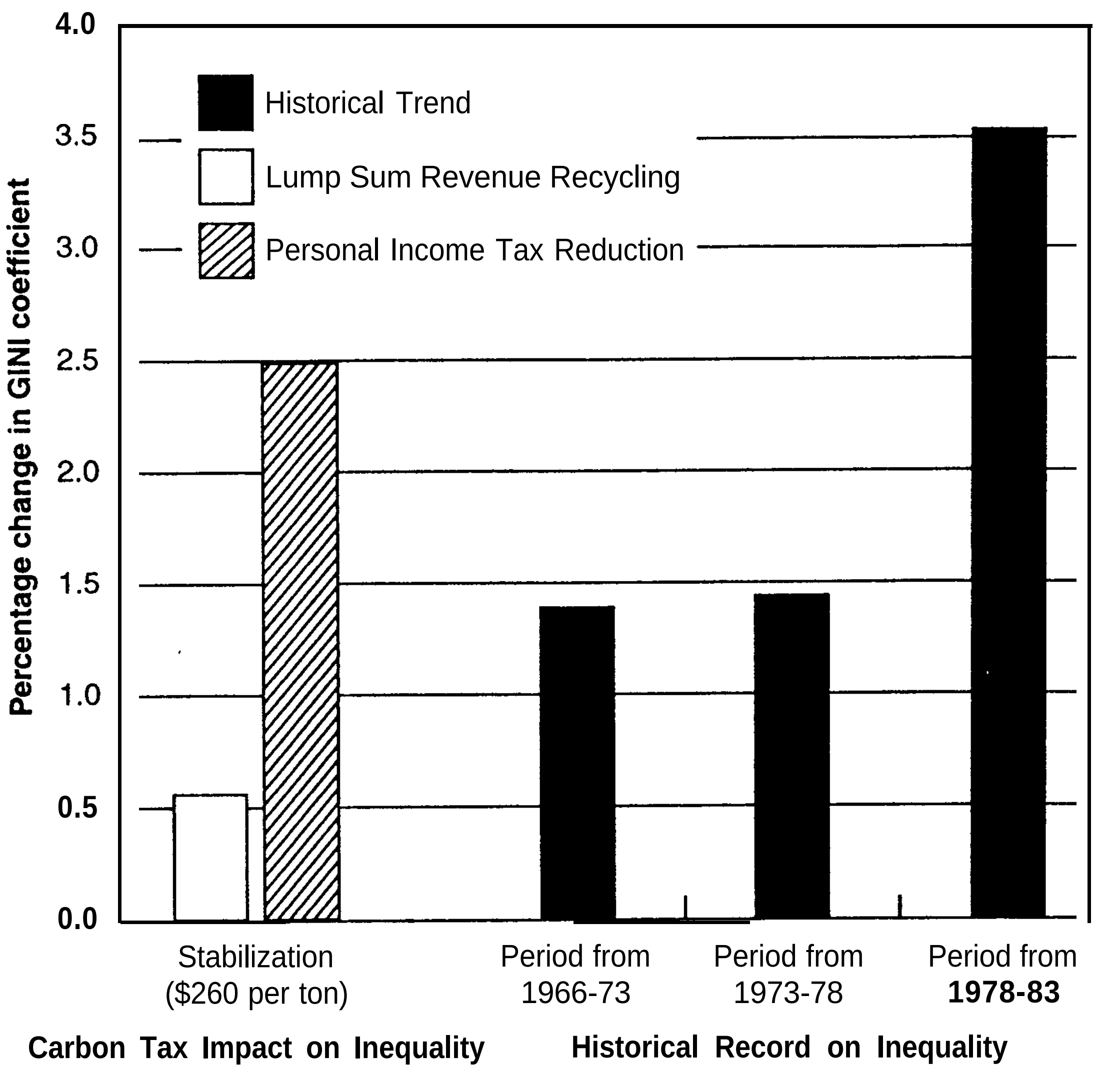
Figure 3 The Impact of Stabilizing CO, Emissions at 1990 Levels by 2010 on U.S. Households by Quintile



Note: A $260 per ton tax or tradable permit price of that amount would be needed to stabilize emissions at 1990 levels by 2010 if emission reductions begin in 1997 or 1998. The analysis assumes the tax is rebated through reductions in the personal income tax.

Source: "Climate Change Policies, the Distribution of Income. and U.S. Living Standards" by Gary W. Yohe, in *Climate Change* Policy, Risk *Prioritization*, and U.S. Economic *Growth* (Washington, D.C: American Council for Capital Formation Center for Policy Research, June 1997), pp. 13-54.

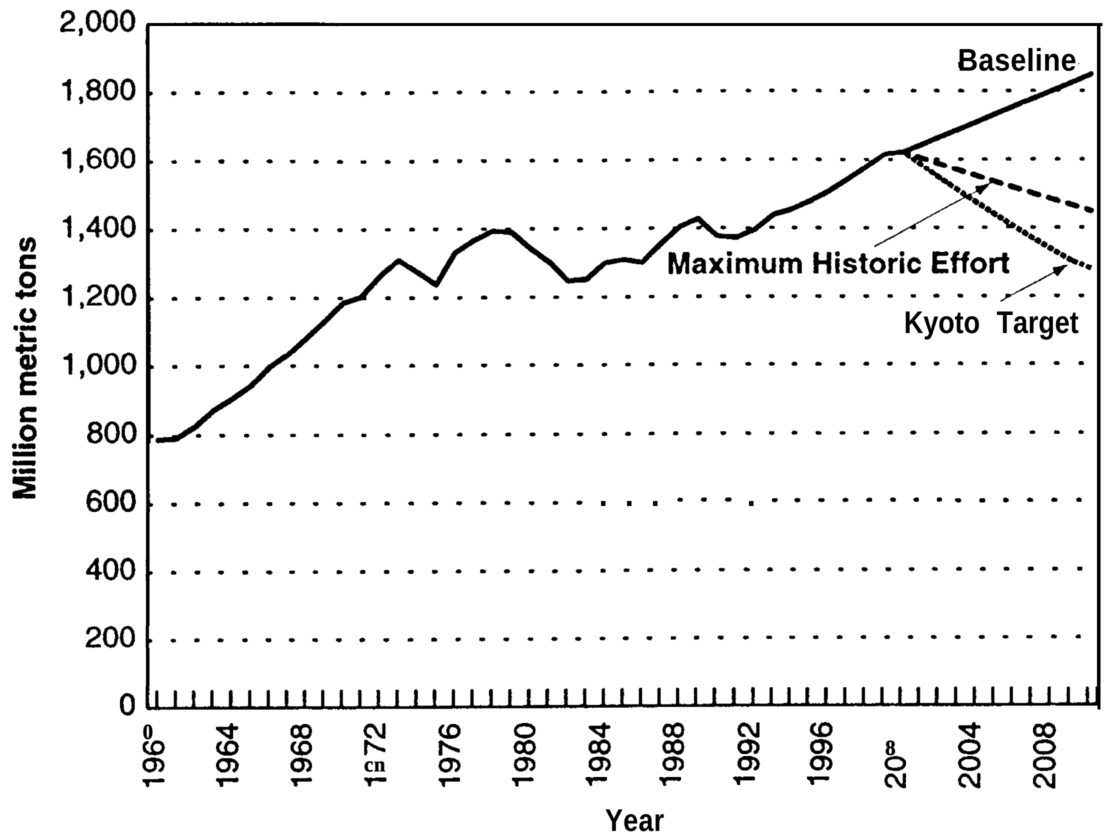
Figure 4 The Impact of Stabilizing CO, Emissions at 1990 Levels by 2010 on Income Inequality in the United States



Note: The bars show changes in GINI coefficients. The higher the bar, the greater the increase in the inequality in the distribution of income. For example, the high unemployment rates and recession in the late 1970s and early 1980s caused those in the lowest quartiles to receive a smaller share of income; thus, the GINI coefficient rose (see black bar). The bars showing the changes in GINI coefficients using either lump sum revenue recycling or personal income tax reductions are based on various econometric models from the 12th Energy Modeling Forum.

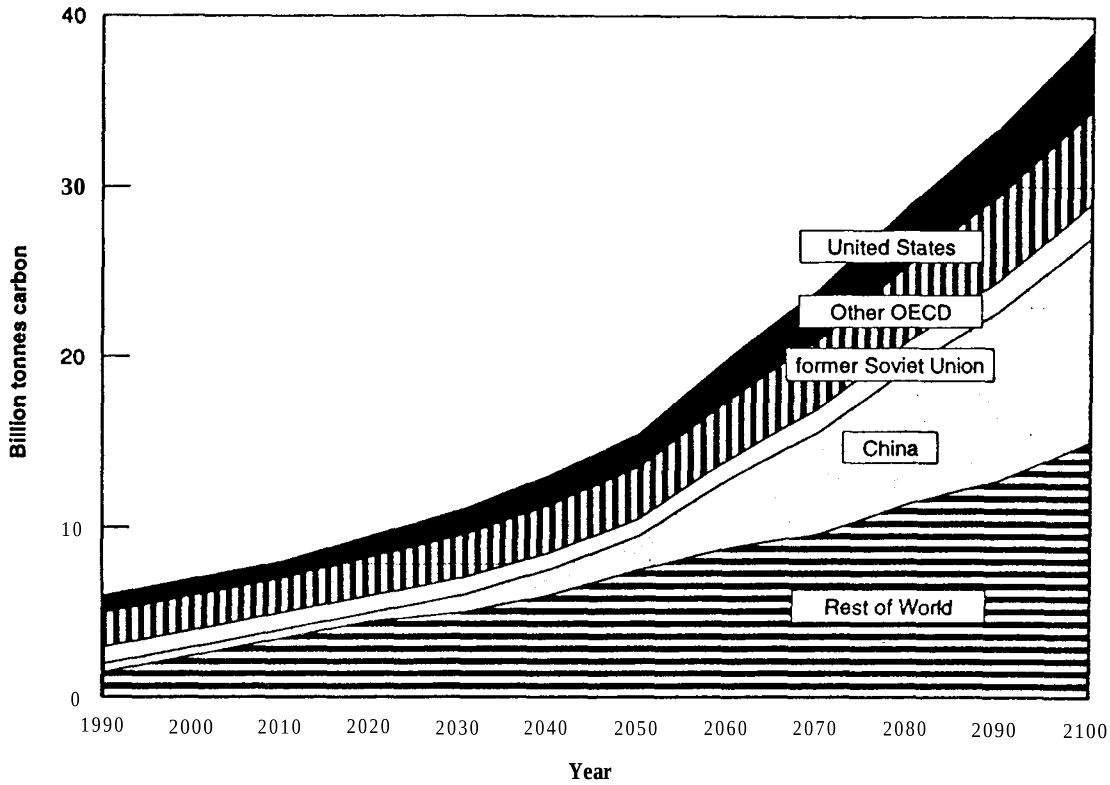
Source: "Climate Change Policies, the Distribution of Income, and U.S. Living Standards" by Gary W. Yohe, in *Climate Change Policy, Risk Prioritization, and U.S. Economic Growth* (Washington. D.C.: American Council for Capital Formation Center for Policy Research, June 1997), pp. 13-54.

Figure 5 U.S. Carbon Emissions: Projected Baseline, Maximum Historic Effort, and the Kyoto Target



Source: Rayola Dougher and Russell Jones, "OECD Country Carbon Emissions: A Kaya Identity Perspective on Historic Emissions and Proposed Emission Reduction Targets and Timetables," Proceedings of *the 21st IAEE Annual International Conference*, forthcoming.

Figure 6 Relative Carbon Contributions of Different Regions to Global Carbon Emissions



Source: Adapted from AS. Manne and R.G. Richels, Buying Greenhouse *Gas Insurance: The Economic Costs* of CO, Emission *Limits* (Cambridge, Mass.: MIT Press, 1992), p. 91, by W. David Montgomery, “Developing a Framework for Short- and Long-Run Decisions on Climate Change Policies,” in An *Economic Perspective on Climate Change Policies* (Washington, D.C.: American Council for Capital Formation Center for Policy Research, February 1996) pp. 15-43.